Take derivatives

1. $\sin x$ $\cos x$
2. $\cos x$ $-\sin x$
3. $\tan x$ $\sec^2 x$
4. $\cot x$ $-\csc^2 x$
5. $\sec x$ $\sec x \tan x$
6. $\csc x$ $-\csc x \cot x$

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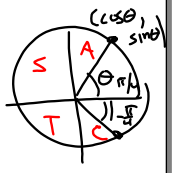
| $x$ | $\sin x$ | $\cos x$ | $\tan x = \frac{\sin x}{\cos x}$ |
|---|---|---|---|
| $0$ | $0$ | $1$ | $0$ |
| $\pi/6$ | $1/2$ | $\sqrt{3}/2$ | $\frac{\sqrt{3}}{\sqrt{3}}\frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$ |
| $\pi/4$ | $\sqrt{2}/2$ | $\sqrt{2}/2$ | $1$ |
| $\pi/3$ | $\sqrt{3}/2$ | $1/2$ | $\sqrt{3}$ |
| $\pi/2$ | $1$ | $0$ | $*$ |




$\cos\frac{\pi}{4} = \cos -\frac{\pi}{4}$

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3.6a Chain Rule

Use chain.tns to discover the amazing chain rule for derivatives of composite functions.

$y = f(g(x)) = (f \circ g)(x)$

outside inside

$y = \sin(x^3 + 7x - 14)$

$$\frac{d}{dx} f(g(x)) = g'(x) \cdot f'(g(x))$$

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$$ $u$ is inside $= g(x)$

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If a particle moves along the x-axis so that its position is given by x(t)=cos(t^2+1), find the velocity.

$v(t) = -2t\sin(t^2+1)$

$2t\left(-\sin(t^2+1)\right)$

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Find dy/dx:

$y = \sin(x^2+x)$ $\quad y' = (2x+1)\cos(x^2+x)$

$y = \sin^5 x = (\sin x)^5$ $\quad y' = \cos x \cdot 5(\sin x)^4$

$y = u^5$

$y = (x^3+2x-1)^4$ $\quad y' = (3x^2+2)4(x^3+2x-1)^3$

$u^4$

$y = (x^3-x)^5\sin(3x)$

$y' = (x^3-x)^5 3\cos(3x) + \sin(3x)\cdot(3x^2-1)\cdot 5(x^3-x)^4$

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